

Philadelphia VA Medical Center
Replacement of AC-19 and
Laboratory Renovation
Philadelphia, PA 19104

April 12, 2012
Issued for Bid
VA Project No. VA244-P-1786
Array Project No. 3515

SECTION 11 53 13
LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 DESCRIPTION

This section includes chemical (general purpose) hoods in designs and configurations specified hereunder.

1.2 DEFINITIONS

A. CHEMICAL OR GENERAL-PURPOSE HOODS

1. BYPASS HOOD: A hood that contains openings above the sash and below the airfoil, which redistribute the air to reduce fluctuations in face velocity and turbulence within the hood, when the sash is re-positioned.

1.3 RELATED WORK

- A. Section 22 15 00, GENERAL SERVICE COMPRESSED-AIR SYSTEMS: Connections to Compressed Air System.
- B. Section 22 11 00, FACILITY WATER DISTRIBUTION: Plumbing Connections.
- C. Section 22 13 00, FACILITY SANITARY SEWERAGE: Plumbing Connections.
- D. Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY and HEALTHCARE FACILITIES: Plumbing Connections.
- E. Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY and HEALTHCARE FACILITIES: Connections to Gas and Vacuum Systems.
- F. Section 22 63 00, GAS SYSTEMS FOR LABORATORY and HEALTHCARE FACILITIES: Connections to Gas and Vacuum Systems.
- G. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION: Integral Blowers on Hoods.
- I. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Face Velocity Sensor Controller.
- J. Section 23 34 00, HVAC FANS.
- K. Section 23 36 00, AIR TERMINAL UNITS: Airflow Control Valves.
- L. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Electrical Connections.
- M. Section 26 27 26, WIRING DEVICES: Electrical Devices.

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N. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Motor Starters.

1.4 PERFORMANCE REQUIREMENTS

- A. Average Face Velocity for general chemical and ductless laboratory fume hoods: 0.51 m/s (100 fpm) with sash located at the average sash stop of 18 inches.
- B. Average Face Velocity for Low Velocity laboratory fume hoods can be as low as 60 fpm with sash located at the average Low Velocity hood sash stop height of 12 to 18 inches.
- C. Containment: Furnish and install laboratory fume hoods that are tested according to ASHRAE 110 at a release rate of 4.0 L/min. (0.1 CFM) (VA Comment: Provide equivalent inch/pound unit.)
 - 1. Face Velocity Variation: Allowable VA variation threshold is not more than $\pm 10\%$ of average face velocity.
 - 2. Sash Position:
 - a. Vertical Rising Sash: 100 fpm with sash at operating height of 18-inches; not less than 60 fpm with sash at full-open for set-up.
 - 3. As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm)
 - 4. As-Installed (AI) Rating: AI 0.1 (0.1 ppm)
 - 5. Static-Pressure Loss: Not more than $1/2$ -inch wg (124 Pa) at 100-fpm (0.51-m/s) face velocity when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.
 - 6. Structural Performance:
 - a. Provide fume hood components capable of withstanding the following loads without permanent deformation, excessive deflection, or binding of cabinet drawers and doors.
 - b. Fume Hood Base Stands as noted in schedule: 50-lb/ft. (74-kg/m) work top, 75 lb/ft. (112 kg/m) on work top, plus weight of hood.
 - 7. Seismic Performance: Fume hoods, including attachments to other work, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and the applicable Building Code requirements.

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- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- b. Seismic Design Criteria: Refer to Architectural Drawings for design information and Building Code criteria.

1.5 QUALITY CONTROL

- A. Source Limitations for Laboratory Fume Hoods: Obtain fume hoods and casework from single manufacturer.
- B. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices. Provide fume hoods UL listed and labeled for compliance with UL 1805.
- C. Safety Glass: Products complying with testing requirements in 16 CFR 1201 for Category II materials.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by UL, and marked for intended location and application.
- E. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable, maintainable, and accessible.
- F. Standard Products: Material and equipment shall be the standard products of the selected manufacturer, and they should be regularly engaged in the manufacture of such products for at least 3 years.
- G. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
- H. Preinstallation Conference: Conduct conference at Project site.

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1.6 SUBMITTALS

A. Manufacturer's Literature and Data: Include the following:

1. Illustrations and descriptions of laboratory fume hoods and factory-installed devices for fume hoods.
2. Catalog or model numbers for each item incorporated into the work.
3. Static-pressure losses and exhaust volumes for fume hoods.
4. Results of testing according to ASHRAE 110.

B. Shop Drawings: For laboratory fume hoods. Include plans, elevations, sections, details, and attachments to other work.

1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports. Include calculations demonstrating that anchorages comply with seismic performance requirements.
2. Indicate locations and types of service fittings together with associated service supply connection required.
3. Indicate duct connections, electrical connections, and locations of access panels.
4. Include roughing-in information for mechanical, plumbing, and electrical connections.
5. Include layout of fume hoods in relation to laboratory casework, equipment and other building construction.

C. Samples: For fume hood exterior finishes, interior lining and work top material, in manufacturer's standard sizes.

D. Product Schedule: For laboratory fume hoods. Use same designations indicated on Drawings.

E. Product Certificates: For each type of laboratory fume hood, from manufacturer, certifying that products furnished comply with requirements.

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- F. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.
- G. Source quality-control reports.
- H. Field quality-control reports.
- I. Operation and Maintenance Data: For fume hoods to include in operation, and maintenance manuals. In addition to items specified in Division 1 include the following:
 - 1. Product Schedule: For each fume hood, include the following:
 - a. Designation indicated on Drawings.
 - b. Manufacturer's name and model number.
 - c. List of factory-authorized service agencies including their addresses and telephone numbers.
- J. Factory Test Reports: Provide manufacturer's QC checklist or other reports that indicate comprehensive factory testing has been performed, and the results of these tests have been certified.
- K. LEED Information:
 - 1. LEED (v 3.0) MR Credit 4, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content:
 - a. Include statement indicating costs for each product having recycled content.
 - 2. LEED (V 3.0) MR Credit 5, Regional Materials: Manufacturer's data identifying point of origin for products procured within 500 mile radius of the project:
 - a. Include statement indicating costs for each product submitted.

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Manufacturer's data identifying point of origin for products
procured within 500 mile radius of the project:

1.2 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.3 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.
- B. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.

1.4 EXTRA MATERIALS

- A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ANSI/ASHRAE):
110-1995.....Method of Testing Performance of Laboratory
Fume Hoods
- C. Scientific Equipment and Furniture Association (SEFA):
1-2010.....Recommended Practices for Laboratory Fume Hoods

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2-2010.....Recommended Practices for Installation

D. National Fire Protection Association (NFPA):

45-2011.....Standard on Fire Protection for Laboratories
using Chemicals

PART 2 - PRODUCTS

2.1 FUME HOODS, GENERAL

- A. Furnish and install laboratory fume hoods that comply with recommendations in SEFA 1
- B. Confirm factory-installed service fixtures and electrical devices in locations shown on drawings.
- C. Ductwork: All ductwork shall be stainless steel. Refer to Section 23 31 00 HVAC DUCTS and CASINGS.
- D. Service-Fixture Color-Coding: Color-code service fixtures as follows:

| Service | Color |
|---------|------------|
| Water | Dark Green |
| Air | Orange |
| Gas | Dark Blue |
| Vacuum | Yellow |

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kewaunee Supreme Air Fume Hood Restricted Bypass or comparable product by one of the following:
 - 1. Mott Manufacturing Ltd.
 - 2. Thermo Scientific, Hamilton Airflow Products.

2.3 MATERIALS

- A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness.

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- C. Glass-Fiber-Reinforced Polyester: Polyester laminate with a chemical-resistant gel coat on the exposed face, and having a flame-spread index of 25 or less per ASTM E 84.
- D. Epoxy: Factory molded of modified epoxy-resin formulation complying with Division 12 Section "Laboratory Casework" and having a flame-spread index of 25 or less per ASTM E 84.

5. Color: Gray.

- E. Glass: Clear, laminated tempered glass complying with ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with two lites not less than 3.0 mm thick each and with clear, polyvinyl butyral interlayer.
- F. Fasteners: Provide stainless-steel fasteners where exposed to fumes.

2.4 FUME HOOD VENTILATION

- A. Restricted Bypass Fume Hoods: Provide restricted bypass fume hoods. Partial compensating bypass above sash opens after sash is closed to less than 20 percent open. Design partial bypass to maintain sufficient exhaust air volume through hood to adequately dilute hazardous fumes regardless of sash position. Exhaust air volume with sash fully closed shall not be less than 25 cfm per square foot of interior work surface.

2.5 FABRICATION

- A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 35-by-79-inch (889-by-2007-mm) door opening.
- B. Steel Exterior: Fabricate from steel sheet, not less than 0.0478 inch (1.2 mm) thick, with component parts screwed together to allow removal

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of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.

- C. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.
- D. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
- E. Interior Lining: Provide one of the following unless otherwise indicated:
 - 1. Glass-fiber-reinforced polyester, not less than 1/4 inch (6.35 mm) thick.
- F. Lining Assembly: Unless otherwise indicated, assemble with stainless-steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling with chemical-resistant sealant during assembly.
 - 1. Fasten lining components together with stainless-steel cleats or angles to form a rigid assembly to which exterior panels are attached.
 - 2. Punch fume hood lining side panels to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings.
 - 3. Interior Access Panels: Provide interior gasketed access panels at end wall panels of fume hoods for access to end wall utility services.
- G. Rear Baffle: Unless otherwise indicated, provide baffle, of same material as fume hood lining, at rear of hood with openings at top and bottom for airflow through hood. Secure baffle to cleats at rear of

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hood with stainless-steel screws. Fabricate baffle for easy removal for cleaning behind baffle.

1. Provide preset baffles unless otherwise indicated.
2. Provide epoxy-coated, stainless-steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.

H. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.

1. Duct-Stub Material: stainless steel unless otherwise indicated.

I. Bypass Grilles: Provide grilles at bypass openings of bypass and restricted bypass fume hoods.

J. Sashes: Provide operable sashes of type indicated.

1. Unframed Vertical Rising Sash: Fabricate sash with bottom rail of ~~0.0478-inch-~~ (1.2-mm-) minimum thickness steel sheet, with chemical-resistant finish and extruded PVC sash guides/glazing channels. Provide bottom rail with integral formed flush pull, full width of bottom rail.

2. Sash Opening Height:

- a. Bench-Top Fume Hoods: 27 to 30 inches (685 to 762 mm) unless otherwise indicated.

K. Airfoil: Unless otherwise indicated, provide airfoil at bottom of fume hood face opening with 1-inch (25-mm) space between airfoil and work top. Sash closes on top of airfoil, leaving 1-inch (25-mm) opening for air intake. Airfoil directs airflow across work top to remove heavier-than-air gases and to prevent reverse airflow. Fabricate airfoil from stainless steel.

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1. Airfoil Option: In lieu of airfoil design with opening above work top, provide nominal 1-inch (25-mm) open bypass when sash closes on top of airfoil; top of airfoil and sill are flush with the top of work top. A secondary containment trough shall be located in front of the countertop and extend below the airfoil sill; trough shall have drain capabilities. Airfoil shall be hinged to provide access for cleaning the containment trough. Fabricate airfoil from steel, finish to match exterior of fume hood.
- L. Light Fixtures: Provide vaporproof, two-tube, rapid-start, fluorescent light fixtures, of longest practicable length; complete with tubes at each fume hood. Shield tubes from hood interior with 1/4-inch- (6.35-mm-) thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets. Provide units with fluorescent tubes easily replaceable from outside of fume hood.
 1. Provide fluorescent tubes with color temperature of 3500 K and minimum color-rendering index of 85.
 2. Provide one fixture for hoods less than 96 inches long. Provide two fixtures for hoods 96 inches long and one fixture for each additional 72 inches of hood length.
- M. Base Cabinets: Comply with Division 12 Section "Laboratory Casework."
- N. Work Tops and Sinks:
 1. Work Tops, General: Provide units with smooth surfaces free of defects. Make exposed edges and corners straight and uniformly beveled. Where acid storage cabinets are indicated beneath fume hoods, provide holes in work tops as need to accommodate cabinet vents.
 2. Resin Work Tops: Provide front overhang of 1 inch (25 mm), with continuous drip groove on underside 1/2 inch (13 mm) from edge.
 - a. Work Top Material: Solid epoxy composition.

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- b. Work Top Configuration: Raised (marine) edge, 1-1/4 inches (32 mm) thick at raised edge, with beveled or rounded edge and corners.
- 3. Sinks, General: Comply with requirements of Division 12 Section "Laboratory Casework."
 - a. Cup Sinks:
 - 1) Size: 3 by 6 inch oval.
 - 2) Resin Work Tops: Provide epoxy or polypropylene cup sinks with polypropylene strainers and integral tailpieces.
 - O. Filler Strips: Provide as needed to close spaces between fume hoods or fume hood base cabinets and adjacent building construction. Fabricate from same material and with same finish as fume hoods or fume hood base cabinets, as applicable.
 - P. Ceiling Enclosures: Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to ceiling. Equip front of enclosure panels with removable panel or access panel to provide means to access top of hood and light fixture.
 - Q. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.
 - R. Comply with requirements in Divisions 22, 23 and 26 Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.

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1. Pre-wiring: Fume hoods shall be pre-wired to an accessible junction box(es) at the top of the fume hood. Refer to Division 26 Sections for wiring, conduit and box materials. Make provisions necessary for fume hood control power on top of fume hood; refer to Division 23 Sections for fume hood controls.
 - a. Provide one internal circuit for electrical outlets at fume hood sash opening and one internal circuit for fume hood lighting and controls.
2. Pre-piping: Fume hood water and laboratory gas services shall be pre-piped to 6-inches above top of fume hood, at back of fume hood. Refer to Division 22 and 23 Sections for piping materials for each type of service.

2.6 CHEMICAL-RESISTANT FINISH

- A. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
 2. Colors for Fume Hood Finish: As selected by Architect from manufacturer's full range.

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2.7 ACCESSORIES

- A. Service Fittings: Comply with requirements in Division 12 Section "Laboratory Casework."
1. Provide service fittings with exposed surfaces, including fittings, escutcheons, and trim, finished with acid- and solvent-resistant powder coating complying with requirements in SEFA 7 for corrosion-resistant finishes.
- B. Fume Hood Controls: Variable-air-volume controls to be provided by Division 23 Section for field installation. Provide fume hood with factory cutouts for controller and accessories.
- C. Sash Stops: Provide fume hoods with sash stops to limit hood opening to sash operating height indicated in "Performance Requirements" Article. Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.
- D. Label: Peel-and-stick type label, fume- and reagent-resistant plastic material, identifying operating height and face velocity.
- E. Bypass Grille Blank-off Panel: Provide fume hoods with blank-off panel on bypass grille designed for use with sash stops to reduce exhaust air volume and provide design face velocity with sash at operating height indicated in "Performance Requirements" Article.
- F. Lattice Assembly: Stainless-steel, vertical and horizontal rod lattice assembly with 1/2-inch- (13-mm-) diameter rods at approximately 12 inches (300 mm) o.c., with mounting hardware.
1. Size (Bench Top Fume Hoods): 24 inches (600 mm) high by size required for fume hood width indicated.
 2. Provide lattice assembly for all fume hoods.

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2.8 SOURCE QUALITY CONTROL

- A. Demonstrate fume hood performance before shipment by testing fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article. Provide testing facility, instruments, equipment, and materials needed for tests.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install laboratory fume hoods to comply with SEFA 2.
 - 1. General: Install fume hoods level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels, but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
 - a. Seal joint between work top and fume hood structure with sealant recommended by manufacturer of fume hood and work top materials.
 - 2. Comply with requirements in Division 12 Section "Laboratory Casework" for installing fume hood base cabinets, work tops, and sinks.
 - 3. Comply with requirements in Divisions 22, 23 and 26 Sections for installing water and laboratory gas service fittings and electrical devices.
 - a. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work top material. Securely anchor fittings to fume hoods unless otherwise indicated. Seal penetrations in work top for acid storage cabinet vent pipes.

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3.2 FIELD QUALITY CONTROL

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Perform tests and inspections.

E. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections and to assist in testing.

I. Field test installed fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article to verify compliance with performance requirements.

(1) Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.

(2) After making corrections, retest fume hoods that failed to perform as specified.

A. Coordinate field testing of fume hoods with requirements of Division 23 Section "Testing, Adjusting and Balancing."

B. Prepare test and inspection reports.

3.3 PROTECTING, CLEANING AND ADJUSTING

A. Protect equipment from dirt, water, and chemical or mechanical injury during the remainder of the construction period.

B. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

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C. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's laboratory and maintenance personnel to adjust, operate, and maintain laboratory fume hoods.

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